Engineering Specifications

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Boiler Specifications: Vitocrossal 300, CA3B 6.0

1.0 General

The gas-fired hot water condensing heating boiler shall be fabricated of high grade stainless steel (SA240-316Ti). The heat exchanger shall utilize the Inox-Lamellar heating surface for maximum heat transfer for optimum energy savings. The smooth, non-fin heat exchanger surfaces shall provide a self-cleaning effect while promoting clean combustion through low heat exchanger loading and a straight-through design. The boiler when operating with Natural Gas shall be capable of operating at less than 20 PPM NOx (@ 3% O_2) throughout the firing range through field set-up and adjustment.

The boiler shall use a sectional design, incorporating 3 boiler sections. Each section shall use a modulating compact pre-mix cylindrical stainless steel gas burner with a high-alloy stainless steel surface capable of operating with consistently high efficiency, and wide operating modulation range. Each burner shall be equipped with a variable speed combustion fan for quiet and economical operation.

The boiler vent system shall meet Category IV venting requirements. The vent material shall be UL/ULC/CSA listed for Category IV, made of either stainless steel or polypropylene (PPs), and be water and gas tight. Sidewall venting applications shall be acceptable.

1.1 Performance Criteria

Each boiler shall be designed for operating at:

NG input range	400 - 6000 MBH (117 - 1758 kW)
LPG input range	660 - 6000 MBH (193 - 1758 kW)
Output (thermal efficiency)	5766 MBH (1689 kW)

Boiler turn-down ratio shall be 15:1 for NG, and 9:1 for LPG.

Site-specific conditions, including combustion air temperature, elevation, fuel temperature, calorific value of the fuel, combustion air system design, exhaust system design, voltage fluctuations and other factors, will impact boiler performance. Performance factors affected may include but are not limited to input/output ratings, efficiency, modulation rates and emissions.

Combustion efficiency shall not be below 94.1% and thermal efficiency shall not be below 96.1% as tested to ANSI/AHRI standard 1500 Performance Rating of Commercial Space Heating Boilers / DOE Test Procedure 81 FR 89276 / U.S. Standards ANSI Z21.13/CSA 4.9 / AHRI, BTS-2000 Testing Standard Method to determine the efficiency of Commercial Heating Boilers.

ASME maximum allowable working pressure (MAWP): 160 psig.
ASME maximum water temperature (Fixed High Limit): 210°F (99°C).
Maximum boiler operating temperature (Adjustable High Limit): 203°F (95°C).

The boiler shall operate without a flow switch.

The boiler shall weigh no less than 6894 lbs (3127 kg), including the burner, controls and jacketing.

Heat exchanger surface area shall not exceed 288.8 ft^2 (26.8 m^2).

No additional safety devices shall be required to safeguard against low flow conditions.

The boiler shall be capable of accommodating a 50% glycol mixture.

The boiler shall incorporate wide water passageways, providing low flow resistance.

The condensation rate, controlled by optimum combustion, shall be able to meet a CO_2 value of 10% through the entire firing range.

The standard control options shall be able to operate independently, or integrate with building management system protocols as referenced in the control section.

2.0 Construction

The combustion chamber and heat exchanger shall be constructed of high-grade alloy stainless steel. The flue gas and condensate collector shall be made of a high-grade alloy stainless steel.

The R-value of the insulation shall be equivalent to 4" (100 mm) mineral wool with nylon backing.

The flue gasses shall pass by the return water in a counter-flow direction only, for maximum heat transfer effectiveness.

The heat exchanger shall be of a compact design for ease of handling, and the burners shall be mounted to the top of the individual boiler sections.

The burners shall be constructed from high-grade stainless steel for use with natural gas or liquid propane gas. Burner ignition shall be by a direct spark ignition system.

The burners shall be capable of operating at altitudes of up to 10,000 ft (3,000 m) without change of orifices, but with the use of electronic adjustment/setting.

The burners shall be capable of operating at natural gas pressures from 4 up to 14" W.C. or liquid propane gas pressures ranging from 10 up to 14" W.C.

The burners shall incorporate the electronic high limit, manual reset fixed high limit, and manual reset low gas pressure limit, as well as a common supply high water temperature limit switch and common high flue gas temperature switch.

3.0 Certifications

All individual components shall be accepted as part of the system under the governing body having jurisdiction. Field approval shall not be required for any component. Boiler shall be CSA approved and shall be built in compliance with ASME Section IV, carrying the "H" stamp.

The boiler shall have the following approvals and listings, or be in compliance with:

CSA, CRN, ASME, AHRI, MA State approval

Control Specifications: Vitotronic 300, GW6C

1.0 General

The Vitotronic 300 GW6C shall be integrated into the Vitocrossal 300 CA3B boiler and shall be capable of operating as a standalone boiler control with outdoor reset capabilities or shall be cascadable as part of a multi-boiler system (to a maximum of 8 boiler sections using the Viessmann LON protocol) for boiler set point operation.

In standalone operation the control unit shall provide control for a boiler with one high temperature circuit and two mixing valve circuits with the integrated mixing valve module, using digital weather responsive reset. Additional circuits shall be added with the order of an ancillary mixing valve controller and/or a custom control panel. System components shall use the Viessmann LON communication protocol. The outdoor reset supply temperature of every heating circuit shall result from the outside temperature, the set room temperature, the operating mode and the heating curve.

In cascade operation each boiler is supplied with an integrated LON card for communication between boilers, via the Viessmann LON Protocol. In cascaded operation one boiler section will be selected and programmed as the System and lead control, with the remaining boilers sections being programmed as lag controls. The boilers shall be operated on a set point temperature only generated through the System and lead boiler control and delivered to the cascaded boiler sections via the Viessmann LON protocol. The System and lead control unit shall provide control for a heating system with one high temperature circuit and two mixing valve circuits with the integrated mixing valve module, using digital weather responsive reset. Additional circuits shall be added with the order of an ancillary mixing valve controller and/or a custom control panel.

1.1 General Requirements

The controller shall have the following features:

- (1) 5-inch colour touch screen user interface for System and Lead boiler section control.
- (2) 5-inch colour touch screen user interfaces for Lag boiler service interface.
- Compatible with 3 Viessmann modulating cylinder burners.
- EPROM memory is maintained without main power.
- Control algorithms are PID-based.
- LON ready with integrated Viessmann LON communication module.
- Integrated EA1 extension for 0-10VDC temperature set point signal.
- Quick connect plug & play system for low voltage controls.
- Communication with Modbus, BacNet and LON (Ethernet/IP) shall be available (through accessories gateways).

The controller shall be factory tested and approved by CSA as part of a package with the compatible series of boilers.

The controller shall be able to support the following output devices:

- (3) Viessmann modulating cylinder burners.
- (3) Boiler section isolation valves (internal).
- (1) Boiler pump or system pump.
- (1) Domestic hot water pump.
- (1) Domestic hot water re-circulation pump.
- (2) Low temperature heating loop circulation pumps in conjunction with mixing valves.
- (2) Heating loop modulating mixing valves.

2.0 Construction

2.1 Control Interface

The control interface shall be a digital display capable of displaying temperatures as °C or °F, with menu driven selection functions, with access to the following operating points:

- Able to display all system temperatures and set points.
- Displays unique fault message during an alarm.
- An operating selection mode.
- Domestic hot water temperature set point adjustment.
- Information indicator with confirmation.
- Boiler operating hours display (per boiler section).
- Number of burner starts display (per boiler section).
- Operating status check.
- Emission/service test switch (one for each boiler section).
- Adjustable display contrast.
- Temporary occupied mode function (Comfort mode).
- Temporary occupied mode function (Eco mode).
- Slope and shift adjustment for the heating curve.

2.2 Additional Features

The controller shall have the following additional features:

- On/Off switch.
- Default factory settings reset.
- Operating status indication light.

- Tamper-proof fixed high limit (integrated in burner control).
- Emissions test switch (1 per boiler section).
- Fault Indicator light.
- Operating condition scans.
- Maintenance requirement status.
- Relay test function.
- Integrated boiler flue gas temperature limit switch.
- Participant check (LON nodes).
- Quick heat up and quick set-back functions.
- Start-up and shut-down optimization functions.
- Warm weather shut-down.
- Energy savings mode.
- Ability to restore the control to factory defaults.
- Individual service display for each boiler section.

The fixed high limit shall have the following tamper-proof features:

- CSA certified burner control with integrated Electronic Fixed and Adjustable High limit sensors are used.

2.3 Boiler System Supply Water Temperature Control

Each controlled zone shall have a calculated heating curve which describes the required supply water temperature at different outside air temperatures. The slope and shift of each heating curve shall be adjusted to fit any type of building or system. The highest required temperature of all zones shall be used together with conjunction from an optional room temperature sensor to determine the common boiler supply temperature set-point.

In the unoccupied mode, the supply water temperature set-point shall be reduced by a pre-determined amount. A call for domestic hot water or an external demand signal shall override this set-point to pre-determined values.

Control logic shall be equipped to protect the heating system from freeze-up if left powered during the off season.

2.4 Domestic Hot Water Control

The DHW temperature shall be controlled through starting and stopping the DHW circulation pump. An automatic or individual time program shall be selected for the control of the DHW and the DHW tank re-circulating pump. An individual time program shall enable up to four switching periods per day to be set to control the DHW heating and the DHW re-circulation pump.

The DHW control sequence shall use an adaptive algorithm that takes into account the rate at which the temperature changes and whether the boiler will be required to supply heat after the DHW tank has been heated or whether residual boiler heat should be transferred to the DHW tank. Available domestic hot water strategies shall include: priority control (supply water set-point increases, the mixing valve closes and the heating circuit pumps are shut off on a call for DHW), modulating priority (the supply water set-point of the mixing valve circuits shall be reduced until the DHW supply temperature requirements have been met), or no priority at all.

A frost protection function shall energize the DHW production should the supply water temperature drop below a pre-determined value. An optional second temperature sensor placed in the cold water inlet can be incorporated to determine if DHW production should begin prematurely. If required, a solar heating control strategy using an extra temperature sensor in the solar system shall be selected.

2.5 Fault Management

If a fault occurs on a boiler, the fault code shall be indicated in the display window and by the flashing red fault lamp. A compiled failure alarm contact shall close in order to signal the alarm condition to a Building Automation System (BAS). The message shall also be broadcasted on the LON communication bus. The error history shall be saved to memory.

2.6 Scheduling

There shall be separate time schedules for central heating, DHW heating and the DHW re-circulation pump. Each device shall be able to be scheduled to switch between occupied and unoccupied modes up to four times per day.

2.7 Auxiliary Inputs

The following dry contact inputs shall be available to be wired to each boiler to control the following functions (functionality dependent on operating mode):

- Boiler disable.
- External heat demand.

- Boiler sequencing.
- External enable.
- External blocking.
- Heating program changeover.

2.8 Building Management System Interface

The controller shall have the ability to accept a 0-10V signal from a Building Management System for the purpose of allowing remote control of the boiler supply water temperature set point.

The controller shall be able to fully integrate with Building Management Systems running on the BacNet, Modbus, or LON (Ethernet/IP) communication protocols via a gateway.

2.9 Remote Communication Interface

The controller shall have the ability to be connected to an Internet server interface, which shall allow access to all programming and operating parameters over the World Wide Web without additional accessory components.

The controller shall have the ability to be connected to a Modbus or BACnet BMS system, which shall allow access to all programming and operating parameters using the accessory Vitogate 300 communication gateway.

3.0 Certifications

All individual components shall be accepted as part of the system under the governing body having jurisdiction. Field approval shall not be required for any component.

All electrical wiring is to be done in accordance with the latest editions of:

CSA C22.1 Canadian Electrical Code and/or local electrical codes (for Canada)
ANSI/NFPA 70 National Electrical Code (for U.S.)